

What is claimed is;

1. A fuel injection and ignition system for an internal combustion engine comprising an injector to supply fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to  
5 generate an igniting high voltage to be applied across an ignition plug provided in a cylinder of said internal combustion engine, a controller to control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as a power source to apply a power source voltage to said injector, said fuel pump,  
10 said ignition circuit and said controller;

said power source section adapted to apply said power source voltage from a single voltage regulating power source circuit through a power source line to said controller and said fuel pump and at least one of said injector and said ignition circuit; and

15 said controller comprising pump drive current control means to control a drive current for said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is determined at a voltage or more corresponding to the minimum operation voltage of elements other than said fuel pump, in the course of starting said  
20 engine.

2. A fuel injection and ignition system for an internal combustion engine as set forth in claim 1,

wherein said power source circuit comprises a control rectifier circuit having a hybrid bridge circuit of diodes and thyristors and outputting said  
25 power source voltage to said power source line, and

wherein thyristor control means is provided in said power source section or said controller to control said thyristors so as to limit said voltage of said power source line at said predetermined limited value or less.

3. A fuel injection and ignition system for an internal combustion engine as set forth in claim 1,

wherein said generator comprises a magneto generator,

wherein said power source circuit comprises a rectifier circuit to  
5 rectify said output voltage of said generator and an output shorting switch to short said output of said generator so that said power source voltage is output from said rectifier circuit to said power source line, and

wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch  
10 so as to short said output of said generator when said voltage of said power source line exceeds said predetermined limited value.

4. A fuel injection and ignition system for an internal combustion engine as set forth in claim 1,

wherein said power source circuit comprises a rectifier to rectify said  
15 output current of said generator and a chopper switch to intermittently flow said output current of said generator so that a voltage rectified by said rectifier and regulated by said chopper switch is output to said power source line, and

wherein chopper control means is provided in said power source  
20 section or said controller to control said chopper switch so as to boost said voltage of said power source line when the rotational speed of said internal combustion engine is low and said voltage of said power source line is less than said predetermined limited value and to lower said voltage of said power source line when said voltage of said power source line exceeds said limited  
25 value.

5. A fuel injection and ignition system for an internal combustion engine comprising an injector to supply a fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to

generate an igniting high voltage to be applied across an ignition plug provided in a cylinder of the internal combustion engine, a controller to control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as  
5 a power source to apply a power source voltage to said injector, said fuel pump, said ignition circuit and said controller;

said power source section adapted to apply said power source voltage from a single voltage regulating power source circuit through a power source line to said controller and said fuel pump and at least one of said injector and  
10 said ignition circuit;

a load or loads other than said injector, said ignition circuit, said controller and said fuel pump being connected through energization control switch means to said power source line; and

said controller comprising pump drive current control means to  
15 control a drive current for said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is determined at a voltage or more corresponding to the minimum operation voltage of elements other than said fuel pump, in the course of starting said engine and energization control switch control means to control an  
20 energization control switch in a PWM mode so as to keep an off state of said energization control switch when said engine should be started and keep said voltage of said power source line at an objective voltage set at said reference voltage or more after said engine completes starting.

6. A fuel injection and ignition system for an internal combustion  
25 engine as set forth in claim 5,

wherein said power source circuit comprises a control rectifier circuit having a hybrid bridge circuit of diodes and thyristors and outputting said power source voltage to said power source line, and

wherein thyristor control means is provided in said power source section or said controller to control said thyristors so as to limit said voltage of said power source line at said predetermined limited value or less.

7. A fuel injection and ignition system for an internal combustion  
5 engine as set forth in claim 5,

wherein said generator comprises a magneto generator,

wherein said power source circuit comprises a rectifier circuit to rectify said output voltage of said generator and an output shorting switch to short said output of said generator so that said power source voltage is output  
10 from said rectifier circuit to said power source line, and

wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch so as to short said output of said generator when said voltage of said power source line exceeds said predetermined limited value.

15 8. A fuel injection and ignition system for an internal combustion engine as set forth in claim 5,

wherein said power source circuit comprises a rectifier to rectify said output current of said generator and a chopper switch to intermittently flow said output current of said generator so that a voltage rectified by said  
20 rectifier and regulated by said chopper switch is output to said power source line, and

wherein chopper control means is provided in said power source section or said controller to control said chopper switch so as to boost said voltage of said power source line when the rotational speed of said internal  
25 combustion engine is low and said voltage of said power source line is less than said predetermined limited value and to lower said voltage of said power source line when said voltage of said power source line exceeds said limited value.

9. A fuel injection and ignition system for an internal combustion engine comprising an injector to supply a fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to generate an igniting high voltage to be applied across an ignition plug  
5 provided in a cylinder of the internal combustion engine, a controller to control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as a power source to apply a power source voltage to said injector, said fuel pump, said ignition circuit and said controller;

10        said power source section adapted to apply said power source voltage from a single voltage regulating power source circuit through a power source line to said injector, said ignition circuit, said controller and said fuel pump; and

      said controller comprising pump drive current control means to  
15 control a drive current of said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is determined at a voltage or more corresponding to a higher operation voltage among the minimum operation voltages of said injector and said ignition circuit in the course of starting said engine.

20        10. A fuel injection and ignition system for an internal combustion engine as set forth in claim 9,

      wherein said power source circuit comprises a control rectifier circuit having a hybrid bridge circuit of diodes and thyristors and outputting said power source voltage to said power source line, and

25        wherein thyristor control means is provided in said power source section or said controller to control said thyristors so as to limit said voltage of said power source line at said predetermined limited value or less.

      11. A fuel injection and ignition system for an internal combustion

engine as set forth in claim 9,

wherein said generator comprises a magneto generator,

wherein said power source circuit comprises a rectifier circuit to rectify said output voltage of said generator and an output shorting switch to  
5 short said output of said generator so that said power source voltage is output from said rectifier circuit to said power source line, and

wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch so as to short said output of said generator when said voltage of said power  
10 source line exceeds said predetermined limited value.

12. A fuel injection and ignition system for an internal combustion engine as set forth in claim 9,

wherein said power source circuit comprises a rectifier to rectify said output current of said generator and a chopper switch to intermittently flow  
15 said output current of said generator so that a voltage rectified by said rectifier and regulated by said chopper switch is output to said power source line, and

wherein chopper control means is provided in said power source section or said controller to control said chopper switch so as to boost said  
20 voltage of said power source line when the rotational speed of said internal combustion engine is low and said voltage of said power source line is less than said predetermined limited value and to lower said voltage of said power source line when said voltage of said power source line exceeds said limited value.

25 13. A fuel injection and ignition system for an internal combustion engine comprising an injector to supply a fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to generate an igniting high voltage to be applied across an ignition plug

provided in a cylinder of the internal combustion engine, a controller to control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as a power source to apply a power source voltage to said injector, said fuel pump,  
5 said ignition circuit and said controller;

said power source section adapted to apply said power source voltage from a single voltage regulating power source circuit through a power source line to said injector, said ignition circuit, said controller and said fuel pump;

a load or loads other than said injector, said ignition circuit, said  
10 controller and said fuel pump being connected through energization control switch means to said power source line; and

said controller comprising pump drive current control means to control a drive current of said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is  
15 determined at a voltage or more corresponding to a higher operation voltage among the minimum operation voltages of said injector and said ignition circuit in the course of starting said engine and energization control switch control means to control an energization control switch in a PWM mode so as to keep an off state of said energization control switch when said engine  
20 should be started and keep said voltage of said power source line at an objective voltage set at said reference voltage or more after said engine completes starting.

14. A fuel injection and ignition system for an internal combustion engine as set forth in claim 13,

25 wherein said power source circuit comprises a control rectifier circuit having a hybrid bridge circuit of diodes and thyristors and outputting said power source voltage to said power source line, and

wherein thyristor control means is provided in said power source

section or said controller to control said thyristors so as to limit said voltage of said power source line at said predetermined limited value or less.

15. A fuel injection and ignition system for an internal combustion engine as set forth in claim 13,

5            wherein said generator comprises a magneto generator,

          wherein said power source circuit comprises a rectifier circuit to rectify said output voltage of said generator and an output shorting switch to short said output of said generator so that said power source voltage is output from said rectifier circuit to said power source line, and

10           wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch so as to short said output of said generator when said voltage of said power source line exceeds said predetermined limited value.

15           16. A fuel injection and ignition system for an internal combustion engine as set forth in claim 13,

          wherein said power source circuit comprises a rectifier to rectify said output current of said generator and a chopper switch to intermittently flow said output current of said generator so that a voltage rectified by said rectifier and regulated by said chopper switch is output to said power source  
20    line, and

          wherein chopper control means is provided in said power source section or said controller to control said chopper switch so as to boost said voltage of said power source line when the rotational speed of said internal combustion engine is low and said voltage of said power source line is less  
25    than said predetermined limited value and to lower said voltage of said power source line when said voltage of said power source line exceeds said limited value.

17. A fuel injection and ignition system for an internal combustion



engine comprising an injector to supply fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to generate an igniting high voltage to be applied across an ignition plug provided in a cylinder of the internal combustion engine, a controller to  
5 control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as a power source to apply a power source voltage to said injector, said fuel pump, said ignition circuit and said controller;

said power source section adapted to apply said power source voltage  
10 from a voltage regulating power source circuit comprising said generator as a power source through a power source line to one of said injector and said ignition circuit, said controller and said fuel pump and apply said power source voltage to the other of said injector and said ignition circuit through a circuit of a system separate from said power source circuit; and

said controller comprising pump drive current control means to  
15 control a drive current of said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is determined at a voltage or more corresponding to the minimum operation voltage of elements other than said fuel pump, in the course of starting said  
20 engine.

18. A fuel injection and ignition system for an internal combustion engine as set forth in claim 17,

wherein said power source circuit comprises a control rectifier circuit having a hybrid bridge circuit of diodes and thyristors and outputting said  
25 power source voltage to said power source line, and

wherein thyristor control means is provided in said power source section or said controller to control said thyristors so as to limit said voltage of said power source line at said predetermined limited value or less.

19. A fuel injection and ignition system for an internal combustion engine as set forth in claim 17,

wherein said generator comprises a magneto generator,

wherein said power source circuit comprises a rectifier circuit to  
5 rectify said output voltage of said generator and an output shorting switch to short said output of said generator so that said power source voltage is output from said rectifier circuit to said power source line, and

wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch  
10 so as to short said output of said generator when said voltage of said power source line exceeds said predetermined limited value.

20. A fuel injection and ignition system for an internal combustion engine as set forth in claim 17,

wherein said power source circuit comprises a rectifier to rectify said  
15 output current of said generator and a chopper switch to intermittently flow said output current of said generator so that a voltage rectified by said rectifier and regulated by said chopper switch is output to said power source line, and

wherein chopper control means is provided in said power source  
20 section or said controller to control said chopper switch so as to boost said voltage of said power source line when the rotational speed of said internal combustion engine is low and said voltage of said power source line is less than said predetermined limited value and to lower said voltage of said power source line when said voltage of said power source line exceeds said limited  
25 value.

21. A fuel injection and ignition system for an internal combustion engine comprising an injector to supply a fuel to said internal combustion engine, a fuel pump to supply said fuel to said injector, an ignition circuit to

generate an igniting high voltage to be applied across an ignition plug provided in a cylinder of the internal combustion engine, a controller to control at least said injector and said ignition circuit, and a power source section having an AC generator driven by said internal combustion engine as  
5 a power source to apply a power source voltage to said injector, said fuel pump, said ignition circuit and said controller;

said power source section adapted to apply said power source voltage from a voltage regulating power source circuit comprising said generator as a power source through a power source line to one of said injector and said  
10 ignition circuit, said controller and said fuel pump and apply said power source voltage to the other of said injector and said ignition circuit through a circuit of a system separate from said power source circuit;

a load or loads other than said injector, said ignition circuit, said controller and said fuel pump being connected through energization control  
15 switch means to said power source line; and

said controller comprising pump drive current control means to control a drive current of said fuel pump in a PWM mode so as to maintain said voltage of said power source line at a reference voltage or more, which is determined at a voltage or more corresponding to the minimum operation  
20 voltage of elements other than said fuel pump, in the course of starting said engine and energization control switch control means to control an energization control switch in a PWM mode so as to keep an off state of said energization control switch when said engine should be started and keep said voltage of said power source line at an objective voltage set at said reference  
25 voltage or more after said engine completes starting.

22. A fuel injection and ignition system for an internal combustion engine as set forth in claim 21,

wherein said power source circuit comprises a control rectifier circuit

having a hybrid bridge circuit of diodes and thyristors and outputting said power source voltage to said power source line, and

wherein thyristor control means is provided in said power source section or said controller to control said thyristors so as to limit said voltage of  
5 said power source line at said predetermined limited value or less.

23. A fuel injection and ignition system for an internal combustion engine as set forth in claim 21,

wherein said generator comprises a magneto generator,

wherein said power source circuit comprises a rectifier circuit to  
10 rectify said output voltage of said generator and an output shorting switch to short said output of said generator so that said power source voltage is output from said rectifier circuit to said power source line, and

wherein output shorting switch control means is provided in said power source section or said controller to control said output shorting switch  
15 so as to short said output of said generator when said voltage of said power source line exceeds said predetermined limited value.

24. A fuel injection and ignition system for an internal combustion engine as set forth in claim 21,

wherein said power source circuit comprises a rectifier to rectify said  
20 output current of said generator and a chopper switch to intermittently flow said output current of said generator so that a voltage rectified by said rectifier and regulated by said chopper switch is output to said power source line, and

wherein chopper control means is provided in said power source  
25 section or said controller to control said chopper switch so as to boost said voltage of said power source line when the rotational speed of said internal combustion engine is low and said voltage of said power source line is less than said predetermined limited value and to lower said voltage of said power

source line when said voltage of said power source line exceeds said limited value.

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